DOCUMENT RESUME

ED 155 034 SE 024 301

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TITLE 1978 Suggested Fungicide Guide: Fungicide Guide for Commercial Vegetable Growers. Circular 999.
INSTITUTION Illinois Univ., Urbana. Coll. of Agriculture.; Illinois Univ., Urbana. Cooperative Extension Service.
PUB DATE Nov 77
NOTE 9p.; Contains small print in footnotes

EDRS PRICE MF-$0.83 HC-$1.67 Plus Postage.
DESCRIPTORS Agricultural Production; *Environment; *Field Crops; *Pesticides; Safety
IDENTIFIERS Fungicides; Illinois; Pests

ABSTRACT

This circular lists suggested uses of insecticides and fungicides for the control of pests and disease by commercial vegetable growers. Suggestions are given for selection, dosage and application of fungicides to control infestation in all crops of commercial importance. (CS)

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1978 Suggested Fungicide Guide

Fungicide Guide for COMMERCIAL VEGETABLE GROWERS

ED155034

Vegetable fungicide tolerances and intervals approved by the Food and Drug Administration and the Environmental Protection Agency as of October 1, 1977, are presented in this publication. The tables on pages 2 and 3 give the tolerances in parts per million (ppm) and the number of days between the last application at normal rate and the harvest *or* they give the date of last application that will keep residues within tolerances set by the FDA.

The listing of a chemical for a crop does not necessarily constitute recommendation for control of a disease on that crop by the Illinois Cooperative Extension Service or the Agricultural Experiment Station. Specific recommendations are given on pages 4 to 7.

In some instances a tolerance (ppm) has been set but a definite interval has not been established. The absence of an interval does not necessarily mean that the fungicide may not be used on that crop. Use of the fungicide would require such restrictions as "do not apply after first blooms appear" or "do not apply after edible parts form."

In a few cases the interval and dosage have been established, but the allowable ppm residue has not been determined. Here again this does not mean that the fungicide may not be used on that crop. It does mean, however, that until a tolerance is established it must be considered to be zero. Zero tolerances are reviewed each year. Some are cancelled as the manufacturer supplies the EPA with additional data.

Growers must follow a disease control program that will assure the production of vegetables with no excessive fungicide residues. Vegetables marketed with residues exceeding FDA tolerances may be injurious to consumers, may be confiscated, and may cause the grower to be brought to court.

Growers have nothing to fear from the law so long as they use fungicides and other pesticides according to the current label only on the crops specified, in the amounts specified, and at the times specified. The safe grower keeps a record of the products and trade names used, the percentage of active ingredients, dilutions, rates of application per acre, and dates of application. The record sheet provided on page 8 is a convenient place to keep such information.

This circular will be revised each year. Be sure you have the most up-to-date copy.

Prepared by Barry Jacobsen and M. C. Shurtleff, Department of Plant Pathology

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TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC) AND USERS OF THE ERIC SYSTEM"

UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN COLLEGE OF AGRICULTURE COOPERATIVE EXTENSION SERVICE

Urbana, Illinois Circular 999 November, 1977

Issued in furtherance of Cooperative Extension Work, Acts of May 8 and June 30, 1914, in cooperation with the U.S. Department of Agriculture.
JOHN B. CLAAR, Director, Cooperative Extension Service, University of Illinois at Urbana-Champaign.
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SE 024 301

FUNGICIDE USES FOR VEGETABLES, APPROVED BY THE EPA, OCTOBER 1, 1977[a, b]

Crop	Benlate, 0.2-15 ppm	Captan (D) (See ppm below)	Bravo, 0.1-15 ppm	Di-folatan, 0.1-15 ppm	Dyrene, 10 ppm	maneb, 4-10 ppm maneb with zinc salt	mancozeb[e] (See ppm below)	zineb, 4-25 ppm
Asparagus	..	root dip	..	..	..	A[d]	(0.1 ppm), A	A
Beans (dry, lima, snap) lima	14,[c] B (snap only) 28	(25 ppm), pp, 0[c]	7,[c] B (snap only)	..	..	0[c] 4 on limas or snap	..	7[c]
Beet, garden	..	(2 ppm-root, 100 ppm-greens), 0, pp	..	..	..	..	..	7(tops)
Broccoli	..	(2 ppm), pp	0[c]	..	..	(10 ppm), 3 or trim and wash	..	7
Brussels sprouts	..	(2 ppm), pp	0	..	..	7	..	..
Cabbage	..	(2 ppm), pp	0	..	..	(10 ppm), 7	..	7
Cantaloupe (muskmelon)	0	(25 ppm), 0, ph,[d] pp	0	0[c]	0[c]	5	(0 ppm in edible parts), 5[c]	5
Carrot	..	(2 ppm), 0	0	..	..	(7 ppm), 0	(2 ppm) 7, B (tops)	7(tops)
Cauliflower	..	(2 ppm), pp	0	..	..	0	..	7
Celery	(3 ppm), 7	(50 ppm), 0, pb	7	..	0	(5 ppm), strip and wash, 14	(5 ppm), 14	strip and wash, 14
Chinese cabbage	..	..	..	..	..	..	..	7
Corn, sweet and pop	..	(2 ppm), 10, B, pp	14, B[f]	..	..	..	(0.5 ppm-cob and kernel), 7 (5 ppm-fodder and forage, 0.5 ppm-ears)	0, B, C
Cucumber	(1 ppm), 0	(25 ppm), 0, ph, pp	0	0	0	(4 ppm), 5	(4 ppm), 7	5
Eggplant	..	(25 ppm), 0, ph, pb	..	..	..	0	..	0
Endive, escarole	..	..	..	..	..	(10 ppm), 7 and wash	..	10
Fennel	..	..	..	..	..	..	7	..
Kale, collard	..	(2 ppm), pp	..	..	..	(10 ppm), 10 and wash	..	10
Kohlrabi	..	..	..	..	..	0	..	(halfgrown)
Lettuce	..	(100 ppm), 0	..	..	..	(10 ppm), 7 (strip and wash)	..	10
Mustard greens	..	(2 ppm), pp	..	..	..	(10 ppm), 10 and wash	..	10
Onion	..	(50 ppm green, 25 dry), 0, ph	0	0	0	(7 ppm), 0	(0.5 ppm dry), 7, D	10
Peas	..	(2 ppm), pp	..	..	..	..	..	10, C
Pepper	..	(25 ppm), 0, pb, pp	..	..	..	(7 ppm), 0	E	0
Potato, Irish[d]	..	(25 ppm), 0, ph	0	0	0	(0.1 ppm), 0, C	(1.0 ppm), 0	0 and seed, C, pp
Pumpkin	.	(25 ppm), 0, pp	0	..	0	(7 ppm), 0	..	0
Radish	..	..	..	..	0	..	..	0
Rhubarb (greenhouse)	..	(25 ppm), 0	..	..	..	(10 ppm), 0	..	..
Spinach	..	(100 ppm), 0, pp	..	..	..	7 and wash	..	10
Squash	(1 ppm), 0	(25 ppm), 0, pp	0	..	0	(7 ppm), 5	(4 ppm), 5	5
Sugar beet[d]	(0.2 ppm-roots, 15 ppm-tops), 21	0	..	..	..	10, B, C, 14, no feeding restrictions	(2 ppm-roots, 65 ppm-tops), B, 14	..
Swiss chard	..	0	..	..	..	..	..	10
Tomato	(5 ppm), 0	(25 ppm), 0, pp	0	0[c]	0	(4 ppm), 5, F	(4 ppm), 5	5
Turnip, rutabaga	..	(2 ppm), pp	..	..	..	10 and wash	..	(7 ppm), 7-tops
Watermelon	(1 ppm), 0	(25 ppm), 0, pp	0	0	0	5	(0 ppm edible parts), 5[c]	5

[a] No tolerances have been set for these fungicides on dill, horseradish, okra, parsley, and parsnip.
[b] The following abbreviations are used:
A = Post-harvest application to ferns only or to young plantings that will not be harvested.
B = Do not feed treated tops or forage to livestock.
C = Do not use treated seed or seed pieces for feed or food.
D = Do not apply to exposed bulbs.
E = Do not apply after fruit buds form.
F = To avoid damage, do not use on tender young plants.
pb = Plant bed treatment.
ph = Post-harvest spray or dip.
pp = Preplant soil treatment.
[c] Mancozeb is sold as Dithane M-45 and Manzate 200.
[d] Tolerances are not needed for pesticides applied only to the foliage and not translocated to the tubers or roots.
[e] Number indicates number of days between last application and harvest; 0 = up to harvest.
[f] Do not apply if crop is to be used for processing.
[g] Machine harvest only.

LABEL INFORMATION ON FUNGICIDES OF LESS GENERAL USE

Fungicide (tolerance)	Crops and use restrictions
Botran	**Beans** (snap) — white mold, 2 days to harvest. Do not feed forage to livestock. **Greenhouse tomato** — to harvest. Do not drench seedlings or newly set transplants. **Carrot** — post-harvest dip or spray, see label. **Garlic, Onion** — soil application before seeding or spray to soil around sets or bulbs. *Do not plant spinach* as follow-up crop in treated soil. **Leaf lettuce** (greenhouse) — 14 days[a] (do not apply to wilted plants or seedlings). **Head lettuce** — 14 days. **Celery** — 7 days. **Cucumber** (greenhouse) — see label. **Rhubarb** (greenhouse) — 3 days. **Potato** — 14 days (do *not* feed to livestock). **Sweet potato** — root dip and plant bed treatment. **Note:** Do not plant tomatoes as followup in treated soil. Don't use spent roots for food or feed. Post-harvest spray or dip as directed.
Copper fungicides[b]	
tribasic copper sulfate (Kobasic, Triangle, Tri-basic Copper Sulfate, etc.)	**Bean, beet, broccoli, cabbage, cantaloupe, carrot, cauliflower, celery, cucumber, eggplant, honeydew melon, lettuce, muskmelon, onion, pea, potato, pumpkin, radish, spinach, squash, tomato, watermelon.**
copper sulfate (many)	**Bean, broccoli, cabbage, cantaloupe, cassaba melon, cauliflower, celery, cucumber, honeydew melon, muskmelon, Persian melon, potato, pumpkin, radish, squash, tomato, watermelon.**
copper resinate (Citcop 4E, Cop-O-Cide, Emulsifiable Liquid Copper Fungicide)	**Bean, cantaloupe, cauliflower, chinese cabbage, cucumber, honeydew melon, lettuce, onion, pepper, pumpkin, squash, tomato, turnip, watermelon.**
copper ammonium carbonate (Copper-Count N)	**Bean, cabbage, carrot, crenshaw melon, celery, cantaloupe, cassaba melon, cucumber, honeydew melon, lettuce, muskmelon, pepper, Persian melon, potato, squash, tomato, watermelon.**
copper hydroxide (Kocide 101 and 404)	**Bean, cantaloupe, carrot, celery, cucumber, honeydew melon, muskmelon, pepper, potato, pumpkin, squash, tomato, watermelon.**
copper oxychloride sulfate (COCS, Copro 50 and 53)	**Bean, beet, broccoli, cabbage, cantaloupe, carrot, cassaba melon, cauliflower, celery, crenshaw melon, cucumber, eggplant, honeydew melon, lettuce, muskmelon, onion, pea, Persian melon, potato, pumpkin, spinach, squash, tomato, watermelon.**
bordeaux mixture (Acme Bordeaux mixture, Pattersons Bordeaux mixture, Bor-Dox, Ortho Bordo mixture, etc.)	**Cress, cucumber, eggplant, honeydew melon, muskmelon, Persian melon, potato, pumpkin, radish, squash, tomato, turnip, watermelon.**
Dexon	Cleared *only* for seed-treatment use on **beans, beets, corn, cucumbers, peas, spinach, sugar beets.** Do not use treated seed for food, feed, or oil. Slurry seed treatment for planting in light soils or soils high in clay or organic matter.
dinocap (Karathane)	**Cantaloupe (muskmelon), cucumber, honeydew melon, pumpkin, squash, watermelon** — 7 days. For control of powdery mildew only.
etridiazole (Terrazole, Truban)	Seed treatment: **Beans, peas, sugar beets.**
polyethylene polymer (Polyram) (0 ppm)	**Potato, sugar beet** — no time limitations. **Celery** — 14 days. **Cantaloupe, cucumber, tomato** — 5 days. Do *not* feed **sugar beet** tops to meat or dairy animals. **Celery** — strip, trim, and wash. Post-harvest application to **asparagus ferns.**
PCNB (Terraclor, Brassicol, Fungiclor) (0.1 ppm)	**Beans** — base of plants *before* blossoming, soil and seed treatment at planting, or foliar spray. Do *not* feed treated **Bean** vines to livestock. Do *not* apply after first bloom. **Broccoli, brussels sprouts, cabbage, cauliflower** — transplant solution (¾ pint per plant) or row treatment before transplanting. **Pepper, potato, tomato** — soil treatment at or before planting. **Tomato** (field use only) — transplant solution (½ pt. of 0.2% per plant). **Garlic** — soil and seed treatment at planting.
streptomycin (0.25 ppm)	**Celery, pepper, tomato** — plant beds only (200 ppm spray); **Potato** — **seed-piece treatment only (100 ppm dip or dust).** Soak cut seed pieces less than 30 min. **Beans** — seed treatment for halo blight control. Do not use treated seed for food or feed.
sulfur, lime, and lime-sulfur	Exempt when used with good agricultural practices. See label.
thiabendazole (Mertect)	**Sweet potato** — "seed" root treatment. Do not use treated pieces for food or feed. **Potato** — "seed" tubers only (1,500 ppm-20 sec. dip.
thiram, TMTD (0.5-7 ppm)	**Onion** — Furrow treatment. **Celery** — 7 days (strip, trim, and wash). **Sweet potato** — preplant root dip. **Tomato** — 0 days, for leaf spots and fruit rots. Seed treatment: **Beans, beets, broccoli, brussels sprouts cabbage, cantaloupe, carrot, cauliflower, collard, corn, cucumber, eggplant, endive, kale, kohlrabi, lettuce, okra, onion** (bulb, seed, and set), **peas, pepper, pumpkin, radish, spinach, squash, swiss chard, tomato, turnip, watermelon.** WARNING: Do not use treated seed for food, feed, or oil.
triphenyltin (Du-Ter)	**Potato** — early and late blight. May be applied through irrigation systems (solid set or center pivot only).

a Number of days between last application and harvest.
b There are many other copper materials, but these are most widely available and labeled for use on vegetable crops. Exempt from tolerance if used with good agricultural practices; not exempt if used at time of or after harvest. See label.

CONDENSED FUNGICIDE RECOMMENDATIONS FOR DISEASES OF COMMERCIAL VEGETABLE CROPS FOR 1977

Vegetable	Diseases	Fungicide[a]	Remarks
Asparagus	Rust (RPD934)[b], leaf and branchlet blights	zineb, maneb, mancozeb, or Polyram	Apply to non-harvested fields *throughout* season to August 15; to harvested fields *after* cutting only. Apply at 7- to 10-day intervals. May combine with insecticides to control asparagus beetles, cutworms, etc. (Cir. 897).[b] Polyram on ferns only.
	Root rots	mancozeb, captan	Use as a preplant dip.
Beans (garden, wax, and lima)	Seed decay (RPD915), damping-off, and seed-borne stem blights and root rots	thiram, captan, Terrazole, or chloroneb plus insecticide	Treat seed any time if not previously treated by producer. Plant *only certified*, western-grown seed in warm soil above 65° F.
	Bacterial blights	fixed copper (2-3 lb. metallic/A.)	Apply at weekly intervals. Plant *only certified* western-grown seed.
	Rust, anthracnose, fungus leaf spots, pod and stem spots	maneb, zineb, or Bravo	Apply at 7- to 10-day intervals during moist weather. Combine with insecticides to control bean beetles, aphids, leafhoppers, blister beetles, etc. (Cir. 897).
	Mosaics		Use insecticides to control aphids (NHE-47)[b] that transmit the viruses. Kill aphids *before* they feed (Cir. 897). Control weeds in and around fields (Cir. 907).
	White mold	Botran, PCNB, benomyl	Apply to base of plants just before bloom, or at 25-50% bloom (benomyl). Do not feed treated vines to livestock.
Beets (garden and sugar), Spinach, Swiss chard	Seed rot (RPD915), damping-off, and seed-borne leaf spot and anthracnose	thiram or captan	Treat seed any time or buy treated seed. To control damping-off apply captan (5-7 lb. of 50% WP in 25-30 gal. water/A. or 25-30 lb. of 10% dust/A.) in furrow at planting time.
	Cercospora leaf spot (RPD951), downy mildew	zineb or fixed copper (2-3 lb. metallic/A.)	Apply every 1 to 2 weeks during rainy periods. May combine with insecticides to control aphids, leafhoppers, caterpillars, leaf miners, etc. (Cir. 897).
	Mosaics, virus yellows		Use insecticides to control aphids (NHE-47) and plant bugs that transmit the viruses. Kill insects before they feed (Cir. 897).
Broccoli, Brussels sprouts, Cauliflower, Cabbage, Chinese cabbage, Collard, Mustard, Kale, Kohlrabi, Radish, Rutabaga	Seed rot (RPD915), damping-off, black rot (RPD924), blackleg (RPD955), radish black root (RPD948), Alternaria blight	hot water, then thiram or captan	Buy western-grown seed. Sow *only* seed treated with hot water. Control cabbage root maggots, cutworms, cabbage worms, etc. (Cir. 897). Four-year rotation with non-crucifer crops.
	Wirestem (*Rhizoctonia*) (RPD902), damping-off, seed rot (RPD916), Botrytis blight (RPD942)	PCNB-captan mixture	Dust or spray on soil just before, at, or after planting seed. Follow manufacturer's directions.
	Clubroot (RPD923)	PCNB 75	Apply in transplant water or starter solution, ¾ pt. per plant (about 400 to 600 gal./A.). Do *not* use emulsion form of PCNB.
	Downy mildew, leaf spots, white rust (RPD960), anthracnose, Botrytis blight (RPD942)	maneb, zineb, or Bravo	Apply at 5- to 7-day intervals (3-5 days for radish) in wet weather. Use maneb in seedbed(2 lb./100 gal.). Good coverage important. May need spreader-sticker. May combine with insecticides to control aphids, cabbage worms, etc. (Cir. 897).
	Mosaics, black ringspot		Use insecticides to control aphids (NHE-47) and cabbage worms (NHE-45) that transmit the viruses. Kill insects *before* they feed — especially in seedbeds (Cir. 897).
	Brittle root (primarily horseradish)		Use insecticides to control leafhoppers that transmit the virus (Cir. 897). Apply when leafhoppers are *first* noticed. Additional applications may be necessary if infestation is severe.
Horseradish	Leaf spots	fixed copper	
Carrot, Parsnip	Seed rot (RPD915), damping-off	thiram or captan	Treat seed any time. May combine with insecticides.
	Aster yellows (RPD903)		Use insecticides to kill leafhoppers that transmit the mycoplasma, *before* they feed (Cir. 897). Begin when plants are 2-3 inches tall; apply weekly for 4 weeks Control weeds in and around plantings (Cir. 907).
	Cercospora leaf spot, Alternaria leaf blight (RPD938)	captan, maneb, mancozeb, zineb, or Bravo	Apply at 5- to 10-day intervals in rainy periods. Thorough coverage essential. Start around June 15.

[a] Dosages: The quantity of material listed is the pounds of active (actual) ingredient to be applied to 1 acre unless stated otherwise (i.e., 3 lb./A.; 2 lb. 50% WP; 20 lb. 5% dust). Abbreviations used: A = acre; WP = wettable powder; pt. = pint(s); gal. = gallon(s); T. = tablespoon(s) (level); sq. ft. = square foot or feet.

[b] RPD = Report on Plant Diseases; NHE = Natural History Entomology publication. General references: Circular 897, Insect Pest Management Guide — Commercial Vegetable Crops and Greenhouse Vegetables; and Circular 907, Herbicide Guide for Commercial Vegetable Growers. Materials available in County Extension Offices.

CONDENSED FUNGICIDE RECOMMENDATIONS (continued)

Vegetable	Diseases	Fungicide	Remarks
Celery, Parsley	Seed rot (RPD915), damping-off, seed-borne blights	hot water, then thiram or captan	Treat seed just before planting or buy treated seed. If damping-off starts, spray plants and soil 2 to 3 times, 5-7 days apart. Use zineb (1 T./gal.). Three-year-old seed is free of late blight.
	Leaf blights and leaf spots	maneb, zineb, benomyl, Dyrene, Bravo, mancozeb	Apply every 7-10 days in field except during very dry weather.
	Mosaics, calico, ringspot		Use insecticides to control aphids (NHE-47) that transmit the viruses. Kill aphids *before* they feed (Cir. 897). Control weeds in and around plantings (Cir. 907).
	Aster yellows (RPD903)		Use insecticides to control leafhoppers that transmit the mycoplasma. Kill insects *before* they feed. Control weeds in and around plantings (Cir. 907).
Corn (sweet and pop)	Seed rot (RPD915), seedling blights, seed-borne root and stalk rots, leaf blights	Captan, zineb, Vitavax-thiram, or thiram *plus* insecticide	Treat seed any time or buy seed treated with both a fungicide and an insecticide (NHE-27).
	Bacterial wilt (RPD907)		Apply insecticides over row to control flea beetles (NHE-36) that transmit the wilt bacteria (Cir. 897). One to 6 sprays may be needed, 3 to 5 days apart. Start the day *before* corn comes up.
	Helminthosporium leaf blights	mancozeb, Polyram, or Bravo	Begin when disease first appears. Repeat at 7-day intervals or as required.
	Rust	zineb	Same as above.
Cucumber, Muskmelon (Cantaloupe), Pumpkin, Squash, Watermelon	Seed rot (RPD915), damping-off, angular and Alternaria leaf spots, Fusarium wilt, gummy stem blight or black rot, anthracnose, scab	captan, or thiram *plus* insecticide	Sow *only* certified, western-grown seed. Watering after planting with captan 50W (2 lb./100 gal. at 1 gal./125 sq. ft., every 5-7 days) controls damping-off. May combine with insecticides (Cir. 897) to control seed-corn maggots (NHE-27) in seedbed. Use 3- to 4-year rotation.
	Bacterial wilt (RPD905)		Use insecticides to control cucumber beetles (NHE-46) that transmit the causal bacteria. Kill beetles *before* they feed (Cir. 897). Applications needed from young seedlings to mature plants. Thorough coverage is essential.
	Anthracnose (RPD920), downy mildew (RPD927), scab (RPD928), blossom blight, leaf spots and blights (RPD918), fruit spots and rots, gummy stem blight or black rot	maneb, mancozeb, zineb, Bravo, Difolatan, Dyrene, or benomyl	Use captan or ziram (2-3 lb./100 gal.) on young plants. Apply at 7- to 10-day intervals from seedling emergence to vining. Start other materials *after* vines begin to run. Repeat at 5- to 10-day intervals to 7-10 days before harvest; keep new growth protected. May combine with insecticides to control cucumber beetles, aphids, vine borer, pickle worm, etc. (Cir. 897).
	Angular leaf spot (RPD919)	fixed copper (2-3 lb. metallic/A.) or soluble copper	Apply at 5- to 7-day intervals in warm, wet weather; or mix with zineb or maneb (2 lb./A.). Begin when plants start to vine or disease *first* appears.
	Mosaics (RPD926)		Use insecticides to control aphids (NHE-47) and beetles (NHE-46) that transmit the viruses (Cir. 897). Kill insects *before* they feed. Control weeds (Cir. 907).
	Powdery mildew (RPD925)	Karathane WD, benomyl (8 oz./100 gal.), Bravo *plus* spreader-sticker	Dust or spray. Thorough coverage essential. Repeat 5-10 days later. Do not apply within 7 days of harvest. Use benomyl alone.
Eggplant	Seed rot (RPD915), seed-borne anthracnose, Phomopsis blight (RPD949), and Verticillium wilt (RPD950)	hot water, then thiram or captan	Treat seed just before planting.
	Damping-off (RPD916)	captan	Seedbed or flat spray, 5 gal./100 sq. ft. Repeat at 5- to 7-day intervals.
	Blight (Phomopsis, Alternaria, Cercospora) (RPD949), anthracnose	maneb, zineb, or captan	Start when disease is first evident, *or* when first fruits are half mature. Repeat at 7- to 10-day intervals. *Do not use copper fungicides on eggplant.* May combine with insecticides (Cir. 897).
Lettuce, Endive	Seed rot (RPD915), damping-off (RPD916), gray mold (RPD942)	thiram, Botran, ferbam, zineb	Dust seed lightly with captan 75. Then apply Botran as dust or spray just before or just after seeding. For *field use only.*
	Aster yellows (RPD903), white heart		Use insecticides to control leafhoppers that transmit the mycoplasma. Kill leafhoppers *before* they feed (Cir. 897). Applications needed throughout season. Dust or spray weed borders.
	Mosaics (RPD946)		Use insecticides to control aphids (NHE-47) that transmit the viruses. Kill aphids *before* they feed (Cir. 897). Sow *only* mosaic-indexed seed. Control weeds in and around plant-growing areas (Cir. 907). Keep new and old beds as far apart as possible.

CONDENSED FUNGICIDE RECOMMENDATIONS (continued)

Vegetable	Diseases	Fungicide	Remarks
	Gray mold (RPD942), downy mildew, other fungus leaf spots, white rust	ferbam, maneb, or zineb	Apply at 5- to 7-day intervals in cool, damp weather. Do *not* apply within 10 days of harvest. May combine with insecticides to control aphids, leafhoppers, flea beetles, etc. (Cir. 897).
	Sclerotinia	Botran Botran or ferbam	Botrytis control. Do not apply within 14 days of harvest.
Okra	Seed rot (RPD915), damping-off	thiram	Seed treatment. Apply any time.
Onion, Garlic	Smut (RPD933), seed decay (RPD915), damping-off, seed-borne purple blotch	thiram or captan	Apply to seed any time (RPD933). For *onion sets*, use 1 lb. (100% active) to 20 lb. seed; for *bulb onions*, wet seed with Methocel sticker then treat with 8 lb. thiram 75 or captan 75 to 8 lb. seed. For *pickling and green bunching onions*, same as for bulb onions; but use half dosage. Control seed- and bulb-feeding insects (Cir. 897).
	Blast (RPD931), downy mildew, purple blotch, gray mold blight (RPD942), neck rot (RPD930)	maneb, Difolatan, Bravo 6F, Dyrene, mancozeb, or zineb *plus* spreader-sticker	Apply every 5 to 7 days in moist weather. May combine with insecticides to control thrips, onion maggots, cutworms, etc. (Cir. 897).
	Yellow dwarf, mosaics		Use insecticides to control aphids (NHE-47) that transmit the viruses. Kill aphids *before* they feed (Cir. 897). Keep new and old plantings *as far apart* as possible.
Pea, Lentil	Seed decay (RPD915), damping-off, seed-borne foot rots, Ascochyta and Mycosphaerella blights (RPD945), Fusarium wilts (RPD912), and bacterial blights	Dexon, thiram, captan, or zineb *plus* insecticide	Treat seed any time or buy seed treated with fungicide-insecticide. Sow certified, western-grown seed. Where captan or thiram are used, friction may reduce seeding rate; add graphite (1 oz./bu.).
	Leaf and stem spots or blights (RPD945)	zineb	Apply weekly in rainy weather where diseases have been severe in past.
	Mosaics (RPD947), streaks, stunt, mottle, wilt		Use insecticides to control aphids (NHE-47) and other insects that transmit the viruses. Kill insects *before* they feed (Cir. 897). Also treat field borders.
	Powdery mildew	lime-sulfur dust (4-6 ratio) 30 lb./A.	Do not apply at air temperature above 80° F. or when plants are in flower. Two applications, a week apart, when mildew *first* appears, should be sufficient.
Peanut	Seed rot (RPD915), seedling blights	Botran, thiram, Difolatan, or captan	Treat seed anytime. Do not use treated seed for food, feed, or oil.
Potato, Irish	Seed-piece decays (RPD915), and seed-borne Verticillium wilt (RPD950)	captan, maneb, Polyram, zineb, or mancozeb	Apply as dust or dip to cut and uncut tubers. Follow manufacturer's directions. Tubers should be well corked over. Plant in warm (over 50° F.) soil.
	Blackleg (RPD943)	streptomycin	May combine with treatment for seed-piece decays. Use uncut, B-size, certified seed.
	Early blight (RPD935), late blight (RPD936), and minor leaf spots and blights	maneb, mancozeb, Difolatan, Bravo, Polyram, Dyrene, Du-Ter	Apply at 4- to 10-day intervals. If rainy, shorten interval; if dry, lengthen. For "finish-up" sprays use fixed copper (3 lb. metallic/A.). May combine with insecticides (Cir. 897).
	Common scab (RPD909), and black scurf (*Rhizoctonia*)	PCNB(various formulations)	May help on *mineral* soils. Work into top 4-6 inches of soil at or before planting. Follow manufacturer's directions carefully. Dust seed pieces with difolatan or mancozeb.
	Mosaics, leaf roll, mottle, purple-top, yellow dwarf, etc.		Use insecticides to control aphids (NHE-47), leafhoppers (NHE-22), etc., that transmit the viruses. Kill insects *before* they feed (Cir. 897).
Rhubarb	Root and crown rots	fixed copper (3 lb. metallic/A.)	Drench crowns early in spring and after harvest. Plant *only* in *well-drained* soil.
	Leaf and stalk spots, anthracnose	captan, Botran	Avoid applications from 2 weeks before harvest until cutting is completed (greenhouse only). May combine with insecticides (Cir. 897).
	Mosaics, ringspots		Use insecticides to control aphids (NHE-47) that transmit the viruses. Kill aphids *before* they feed (Cir. 897).
Sweet potato	Black rot (RPD953), foot rot (RPD958), Fusarium wilt (RPD954), scurf (RPD957)	Botran thiram (1½ oz./gal.), thiabendazole	Seed dip or bed spray. Dip disease-free roots or sprouts just before planting. Follow manufacturer's directions. Seedbed disinfestation (Cir. 893). Three to 4-year rotation. Strict sanitation. Do not rinse after treatment.
	Storage rots (RPD952)	Botran (as post-harvest dip or in wash water)	Helps reduce transit and market losses caused by Rhizopus soft rot and black rot. Fumigate storage houses with formaldehyde.

CONDENSED FUNGICIDE RECOMMENDATIONS (concluded)

Vegetable	Diseases	Fungicide	Remarks
Tomato, Pepper	Seed decay (RPD915), seed-borne bacterial spot (RPD910), speck and canker (RPD962), early blight (RPD908), Septoria blight, anthracnose, Fusarium wilt (RPD929), leaf mold (RPD941)	hot water, then captan, or thiram	Treat seed, buy treated seed, or certified, disease-free transplants (Cir. 912).
	Bacterial spot (RPD910)	fixed copper-streptomycin mixture	Start when seedlings emerge and apply every 5 days. In *field*, use fixed copper (2-3 lb. metallic/A.) plus maneb or mancozeb (2 lb./A.).
	Damping-off (RPD916) and seedling blights, collar rot (RPD908)	captan, ferbam	Dust or spray in seedbed. Apply as plants emerge so spray runs down stems. Repeat every 4 to 7 days until 10 days before transplanting. Follow the manufacturer's directions.
	Septoria blight (RPD908), early blight, anthracnose, late blight (RPD913) and buckeye rot, gray leaf spot, leaf mold (RPD941)	maneb, mancozeb, Polyram, zineb, Difolatan, Dyrene, Bravo benomyl	Apply every 7 to 10 days *after* first fruit clusters form. Five or more sprays may be necessary, depending on weather. Combine with insecticides to control flea beetles, climbing cutworms, hornworms, fruit flies, etc. (Cir. 897). *Soil surface spray of maneb or Difolatan after last cultivation improves anthracnose control.* Tomato leaf mold and Botrytis control.
	Mosaics (RPD917)		Use insecticides to control aphids (NHE-47) and beetles that transmit the viruses. Kill insects *before* they feed (Cir. 897). Control weeds in and around plant-growing area (Cir. 907). Set out certified, virus-free transplants and start with virus-free seed.
	Blossom-end rot (RPD906)	calcium nitrate (4-6 lb./A.)	Application of 4 or more consecutive sprays in the regular schedule may reduce losses. Start when fruits are the size of grapes. Irrigate to maintain uniform soil moisture.
	Cloudy spot (RPD914)		Use insecticides to control stink bugs that produce cloudy spot by feeding punctures (Cir. 897).
(General diseases that attack most vegetable crops)	Damping-off (RPD916) and seedlings blights; gray mold (RPD942) or Botrytis blight	After planting apply captan, thiram, or zineb (1 T./gal.); ferbam or ziram (2 T./gal.)	Disinfest seedbed soil (Cir. 893), then apply seed treatment (RPD915). Then apply sprays or drenches after planting. Apply *only* if damping-off appears in seedbed and when seedlings need water. (*For crucifers, pepper, peas, beans, tomato, lettuce*, add PCNB to other fungicides to give broad-spectrum control.) Use at least 5 gal. per 1,000 sq. ft. of bed. Repeat at 5- to 7-day intervals when temperature is below 75° F.
	Root knot and other nematodes; Fusarium wilts of various crops (RPD901,904,912,929, 954)	Heat or chemicals may be used. Consult Cir. 893 for names, general precautions, and directions	Disinfest seedbed soil (heat preferred, if available). Follow manufacturer's directions exactly. Fumigants work best in light, loose soils, free of trash, clods, and lumps. Avoid recontamination of treated soil. Best to apply fumigants during the fall that precedes planting. In general, soils must be at least 55° F. at the 6-inch depth with a time lapse of 21-28 days between treating and seeding. Some require gas-tight plastic covers.
	Root and stem or crown rots of various crops (RPD902,911,922,923, 932,948,953)		*Plant resistant varieties when available.*
	Verticillium wilt (RPD950)		

GENERAL SUGGESTIONS ON FUNGICIDE APPLICATION

1. Cover the foliage uniformly. *Ground equipment* — Apply 75 to 125 gallons per acre at approximately 400 pounds per square inch of pressure. Lower volumes and/or pressures may provide adequate coverage, but high-volume, high-pressure applications provide ideal coverage. Make sure the sprayer is functioning properly. Check the nozzles for cleanliness and wear. Boom, height, accuracy of pressure gauge, agitation, and calibration should also be checked. *Aerial application* — Apply recommended amounts of pesticide per acre in 3 to 5 gallons of water. Make sure nozzles are properly aligned and clean, so uniform application is achieved. Cover a swath no wider than is reasonable for the aircraft and boom being used. Spray only those fields which are suitable for aerial application. Avoid fields of irregular shape or topography, particularly if they are bounded by power lines, trees, or other obstructions.

2. Whenever possible spray when the air is still or when wind velocity is not excessive (less than 10 to 12 m.p.h.).

3. Avoid situations where pesticide drift may cause needless problems.

4. When it is compatible with the product label, use a spray adjuvant (surfactant). Some commonly available surfactants are: Colloidal Products X77 (liquid, non-ionic) spreader activator; Colloidal Products Multifilm L. (liquid); Colloidal Products Spray Modifier (liquid, non-ionic) spreader sticker; Millers Nufilm 17 liquid spreader sticker; Millers Nufilm P liquid spreader sticker; Allied Chemical Plyac (liquid) sticker; Rohm and Haas Triton B — 1956 (liquid, non-ionic) spreader sticker; Triton CS7, spreader-binder; and Du Pont Spreader Sticker (liquid) spreader sticker.

RECORD SHEET FOR FUNGICIDE USERS

Date	Vegetable	Chemical	Dosage per acre	Remarks

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